

The Age Distribution of Terrestrial Planets as a Solution to the Cosmic Coincidence Problem

Charles Lineweaver, Chas Egan, and Tamara Davis

(Email: charley@bat.phys.unsw.edu.au)

University of New South Wales, Sydney, Australia

The energy densities of matter and the vacuum are currently observed to be of the same order of magnitude: $\Omega_M = 0.3 \approx \Omega_\Lambda = 0.7$. The cosmological window of time during which this can be the case is relatively narrow. If there is no a priori reason for these densities to be similar, we are presented with the cosmological coincidence problem: Why, just now, do these energy densities happen to be of the same order? This coincidence problem is one of the main motivations for the tracker potentials of quintessence cosmological models. Here we describe how this apparent coincidence is plausibly explained as the result of a temporal selection effect imposed by the age distribution of terrestrial planets in the Universe (*Lineweaver, 2001*). We compute the probability distribution of the values of Ω_M and Ω_Λ when first observed by members of a hypothetical ensemble of observers on terrestrial planets. If the origin and early evolution of observers are constrained to terrestrial planets we show that it is not surprising that we have $\Omega_M \approx \Omega_\Lambda$ today.

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- [a] Lineweaver, C.H., An Estimate of the Age Distribution of Terrestrial Planets in the Universe: Quantifying Metallicity as a Selection Effect, *Icarus*, **151**, 307–313, 2001.

